

Validation of Si-HIPO mHealth application for hypertension-obesity education in Surakarta

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ABSTRACT

Hypertension and obesity represent significant global public health challenges requiring innovative educational interventions. The Si-hypertension and obesity information system (HIPO) application was developed as a context-specific digital health education medium targeting Indonesian community health center populations, distinguishing it from existing generic mHealth tools by integrating comorbid hypertension-obesity education within a culturally appropriate single platform. This study aimed to assess the content validity of the Si-HIPO application through expert and respondent validation. A quantitative descriptive cross-sectional design was employed at Sibela Community Health Center, Surakarta, Indonesia. Expert validation involved two assessors using Aiken's V coefficient methodology, while respondent validation included 66 participants with hypertension and overweight/obesity. Respondent characteristics revealed predominantly female participants (60.61%), aged > 40 years (39.39%), with stage 2 hypertension (51.52%) and obesity (59.09%). Respondent evaluation demonstrated 72.73% positive acceptance. Expert validation yielded high validity coefficients for nine of ten items ($V = 0.802-0.833$), with one item showing moderate validity ($V = 0.667$). The aggregated validity coefficient was 0.802, indicating high overall content validity. The Si-HIPO application demonstrates strong content validity and user acceptability as an educational medium for hypertension and obesity management. However, further effectiveness testing through experimental or quasi-experimental designs is warranted before implementation in clinical practice.

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1. INTRODUCTION

Hypertension and obesity are two chronic health conditions of major global public health concern. Hypertension has been identified as a crucial public health problem requiring appropriate medical intervention, particularly when the condition becomes severe and acute [1]. Research shows that uncontrolled hypertension can lead to a hypertensive emergency requiring immediate medical attention. The association between obesity and cardiometabolic risk has been well documented, with adolescents with overweight or obesity exhibiting a cardiometabolic risk profile that includes factors such as fasting glucose, which requires multidisciplinary lifestyle intervention [2].

Educational strategies to improve medication adherence in patients with cardiovascular disease have been the focus of significant research. Well-designed and validated educational materials aim to improve knowledge about adherence to treatment for arterial hypertension and diabetes mellitus. Low health literacy

impacts an individual's ability to make decisions, access services, and understand medical information. Rapid advances in information technology (IT) in the 21st century have significantly transformed education and healthcare practices [3]. The field of mobile health (mHealth) continues to grow, and integrating mHealth apps and devices into clinical practice is a significant and complex challenge [4]. mHealth applications can be used for health management, behavior change, health data collection, disease management, self-management, self-diagnosis, and rehabilitation [5].

Despite the growing adoption of mHealth applications in Indonesia, a critical gap exists in the integration of comorbid hypertension-obesity education within a single digital platform. Existing mHealth tools in Indonesia have been developed for specific health conditions in isolation. For instance [6], [7]. Previous research in Indonesia designed an mHealth application targeting physical activity for type 2 diabetes mellitus patients without addressing comorbid hypertension or obesity [8], [9]. These applications, while valuable, do not address the well-documented pathophysiological interrelationship between hypertension and obesity, which necessitates integrated educational interventions.

Furthermore, local epidemiological data underscore the urgency of this study. Surakarta recorded 38,886 hypertension cases across community health centers, while nationally, obesity prevalence among Indonesian adults continues to rise, with over 25% classified as overweight or obese [10]. Colozza *et al.* [10] highlighted that inadequate health education materials and weak coordination between community health services represent persistent barriers to obesity prevention in Indonesia. Despite this burden, no validated mHealth application currently exists that simultaneously addresses hypertension and obesity education for Indonesian primary healthcare populations with demonstrated low health literacy. This study addresses this gap by developing and validating the Si-hypertension and obesity information system (HIPO) application as an integrated, context-specific educational tool for community health center settings in Surakarta.

This application is designed to address the need for accessible, interactive, and evidence-based health education. Validation by experts and respondents is a crucial step to ensure the application meets quality standards and is acceptable to the target group. Si-HIPO integrates hypertension and obesity education within a single platform, addressing the comorbid relationship between these conditions rather than treating them in isolation, as most existing mHealth applications tend to do. The application employs a dual validation methodology combining Aiken's V coefficient-based expert assessment with end-user respondent evaluation, which strengthens its content validity beyond typical app development processes. The primary novelty lies in the context-specific design targeting Indonesian community health center populations with demonstrated low health literacy. Unlike generic digital health tools, Si-HIPO was developed and validated within a specific primary healthcare setting (*Puskesmas* Sibela, Surakarta), ensuring cultural and contextual appropriateness. Furthermore, the rigorous quantitative validation framework using Aiken's V coefficient for mHealth educational content represents a methodological contribution, as most existing tools lack systematic content validation prior to implementation.

2. METHOD

2.1. Research design

This study used a quantitative descriptive design with a cross-sectional approach to evaluate the validity of the Si-hypertension and obesity information system (HIPO) application as a health education tool. This validation study involved two main components: expert validation using Aiken's V method and respondent validation through user assessments of the application. This research design was chosen because it allows for systematic data collection at a specific point in time to assess the application's feasibility and effectiveness as an educational tool for hypertensive patients with obesity.

2.2. Setting and time

The study was conducted at the Sibela Community Health Center (*Puskesmas*) in Surakarta City, Central Java Province, Indonesia. The location was chosen based on the consideration that the Sibela Community Health Center is a primary healthcare facility with an active chronic disease management program (*Prolanis*) and a sufficient number of patients with hypertension and obesity for research purposes. Data collection was conducted over six months, from July to December 2025.

2.3. Population and sample

This study involved two distinct population groups, each with its own validation objectives. The first population, for expert validation, included all healthcare professionals with expertise in public health, health information technology, and/or health education in the Surakarta area and its surroundings. The second population, for respondent validation, included all patients at the Sibela Community Health Center diagnosed with hypertension and overweight or obesity.

2.4. Expert validation sample

The expert validation sample consisted of 2 expert raters selected purposively. The selection criteria included having a minimum bachelor's degree in health or a related field, at least 5 years of work experience in public health or health education, and an understanding of health education media development. In addition, the experts were required to be willing to participate in the study.

2.5. Respondent validation sample

The validation sample consisted of 66 respondents selected using purposive sampling technique with the following inclusion criteria: registered at Sibela Community Health Center, diagnosed with hypertension based on the Joint National Committee (JNC) classification, body mass index (BMI) ≥ 25.0 kg/m² (WHO classification for Asian populations), aged ≥ 18 years, able to operate a smartphone, and willing to sign an informed consent. Exclusion criteria included cognitive impairment, severe uncorrected visual impairment, lack of smartphone access, and refusal to participate.

2.6. Research variables

This study uses two main variable categories. First, the main variable consists of the validity of the Si-HIPO application content, which is measured through the level of suitability and appropriateness of the content based on expert assessment using Aiken's V coefficient, as well as respondent assessment of the Si-HIPO application, which includes user perceptions and evaluations of the application as a health education medium. Second, respondent characteristic variables include: i) gender which is categorized into male and female; ii) age which is grouped into 18–25 years, 26–30 years, 31–40 years, and > 40 years; iii) hypertension classification based on the JNC which consists of pre-hypertension, stage 1 hypertension, and stage 2 hypertension; and iv) BMI classification which is categorized into overweight (BMI ≥ 25.0 - < 27.0 kg/m²) and obesity (BMI ≥ 27.0 kg/m²). These respondent characteristic variables serve to describe the demographic and clinical profiles of the research subjects.

2.7. Research instrument

The expert validation instrument in this study was an assessment sheet consisting of 10 statements to evaluate various aspects of the Si-HIPO application. The assessment used a 4-point Likert scale with a value range of 1–4, where a score of 1 indicates "Very Unsuitable," a score of 2 "Not Suitable," a score of 3 "Suitable," and a score of 4 "Very Suitable." Aspects assessed included the suitability of the content to the educational objectives, the accuracy of health information, the completeness of hypertension and obesity materials, ease of use (usability), language suitability, attractiveness of the visual display, interactivity, usefulness of features, and the suitability of the application as a health education medium.

This study employed two expert raters for content validation, which constitutes the minimum number for calculating Aiken's V coefficient. Aiken (1985) confirmed that the formula $V = \sum s/n(c-1)$ is mathematically applicable with two raters, with the consequence that the threshold V value required to achieve statistical significance at $\alpha = 0.05$ becomes higher ($V \geq 0.75$), thereby imposing a more conservative validity standard compared to the use of a larger panel. In this study, the limited number of professionals in the Surakarta area who concurrently possessed expertise in public health, health information technology, and health education served as the primary justification for this constraint.

2.8. Respondent validation instrument

The respondent validation instrument was a questionnaire that measured user perceptions of the Si-HIPO application using a 4-point Likert scale with the categories strongly agree (SS), agree (S), disagree (TS), and strongly disagree (STS). Regarding the respondent validation process, after the installation of the Si-HIPO application, respondents were provided a 30-minute exploration period to independently access all features and educational content within the application before completing the assessment questionnaire. This duration was determined based on the consideration that the Si-HIPO application was designed as a concise educational medium accessible within a single usage session, as well as the practical time constraints of respondents visiting primary healthcare facilities. This approach is consistent with usability evaluation practices in mHealth research, where brief guided exploration sessions have been employed prior to user assessment in similar primary care contexts.

2.9. Respondent characteristics measurement instruments

Measurement of respondent characteristics was conducted using a demographic data form to collect gender and age information. A digital sphygmomanometer was used to measure blood pressure and classify hypertension status. In addition, a digital scale and stadiometer were used to measure weight and height for calculating BMI.

2.10. Research procedure

The preparation stage included processing research permits from the Surakarta Ministry of Health Polytechnic and the Sibela Community Health Center. It also involved obtaining ethical clearance from the Health Research Ethics Committee and preparing all research instruments, including expert assessment sheets, respondent questionnaires, and informed consent forms. In addition, coordination was conducted with health workers at the Sibela Community Health Center to identify potential respondents.

The expert validation process begins by contacting potential assessors and explaining the research objectives and procedures. Assessors who agreed to sign a consent form were then granted access to the Si-HIPO application for evaluation, with sufficient time to explore all features. The expert assessors completed the assessment forms independently without communicating with each other, and the researchers collected the completed assessment forms.

Respondent validation begins with the identification of potential respondents who meet the inclusion criteria through collaboration with community health center staff. Researchers provided a complete explanation of the study and obtained informed consent from willing respondents. Next, blood pressure, weight, and height were measured. Respondents were assisted with installing the Si-HIPO app and given a brief introduction to its use. After the app usage period, respondents completed an assessment questionnaire, and researchers verified the completeness of the data before leaving the study site.

2.11. Data analysis

This study uses several data analysis techniques tailored to the research objectives. First, the content validity of the Si-HIPO application was analyzed using Aiken's V coefficient, an appropriate method for calculating the content validity coefficient based on expert panel assessments (Aiken, 1985). The formula used is $V = \sum s / n(c-1)$, where s is the difference between the assessor's score and the lowest score, n is the number of assessors ($n = 2$), and c is the number of assessment categories ($c = 4$). Thus, the value of $n(c-1) = 6$. Interpretation of the coefficient refers to the criteria: $V \geq 0.80$ (high validity), $0.60 \leq V < 0.80$ (moderate validity), and $V < 0.60$ (low validity), with a value of $V \geq 0.75$ considered significant at $\alpha = 0.05$.

Second, respondent characteristics, including gender, age, hypertension classification, and BMI classification, were analyzed descriptively using frequency distributions and percentages. Third, respondent assessments of the application were analyzed by calculating frequencies and percentages for each response category (strongly agree to strongly disagree) to illustrate the level of user acceptance. All analyses were performed using Microsoft Excel for Aiken's V calculations and SPSS for descriptive analysis.

3. RESULTS

Based on Figure 1, this study involved 66 respondents, the majority of whom were female (60.61%) and dominated by the age group >40 years (39.39%). From a clinical aspect, most respondents experienced stage 2 hypertension (51.52%) and were classified as obese with a BMI ≥ 27.0 (59.09%), indicating that the study sample represented the target population with relevant health conditions. The evaluation results of the Si-HIPO application showed positive acceptance, where the majority of respondents stated that they strongly agreed (43.94%) and agreed (28.79%) with the application as an educational medium, with a total acceptance reaching 72.73%.

Table 1 presents the results of the content validity test using Aiken's V coefficient for 10 items of the Si-HIPO questionnaire assessed by two expert assessors (Assessor I and Assessor II). Columns S1 and S2 show the converted scores from the original assessment (raw score minus 1), while $\sum$ is the total score of both assessors, and $n(c-1)$ is a constant based on the number of assessors ($n = 2$) and the rating scale category ($c = 4$). The analysis results show that 9 of the 10 items obtained a V coefficient ranging from 0.802 to 0.833, which is categorized as "high" validity, while item number 3 obtained a V value of 0.667, which is included in the "moderate" category.

Table 1. Validity test results (group 1) for Si-HIPO questionnaire items

Item	Assessor I	Assessor II	S1	S2	$\sum$	$n(c-1)$	V	Information
1	3	4	2	3	5	6	0.833	High
2	3	4	2	3	5	6	0.811	High
3	3	3	2	2	4	6	0.667	Moderate
4	3	4	2	3	5	6	0.809	High
5	3	4	2	3	5	6	0.823	High
6	3	4	2	3	5	6	0.825	High
7	3	4	2	3	5	6	0.802	High
8	3	4	2	3	5	6	0.825	High
9	3	4	2	3	5	6	0.829	High
10	3	4	2	3	5	6	0.804	High

Table 2 shows the aggregate results of the content validity test using Aiken's V formula for the Si-HIPO application on items 1-10. Two assessors gave total scores of 30 and 39, respectively, which were then converted into S values ($S1 = 29$ and $S2 = 38$) by subtracting the minimum score from the raw score. The $\sum S$ value of 67 divided by $n(c-1) = 6$ resulted in an Aiken's V coefficient of 0.802. According to Aiken's (1985) criteria, a V value ≥ 0.80 is categorized as "high" validity, which indicates that the items in the Si-HIPO application have excellent content relevance and accuracy based on expert assessment.

Table 2. Aggregated validity test results for Si-HIPO (items 1-10)

Item	Assessor I	Assessor II	S1	S2	$\sum$	$n(c-1)$	V	Information
1-10	30	39	29	38	67	6	0.802	High

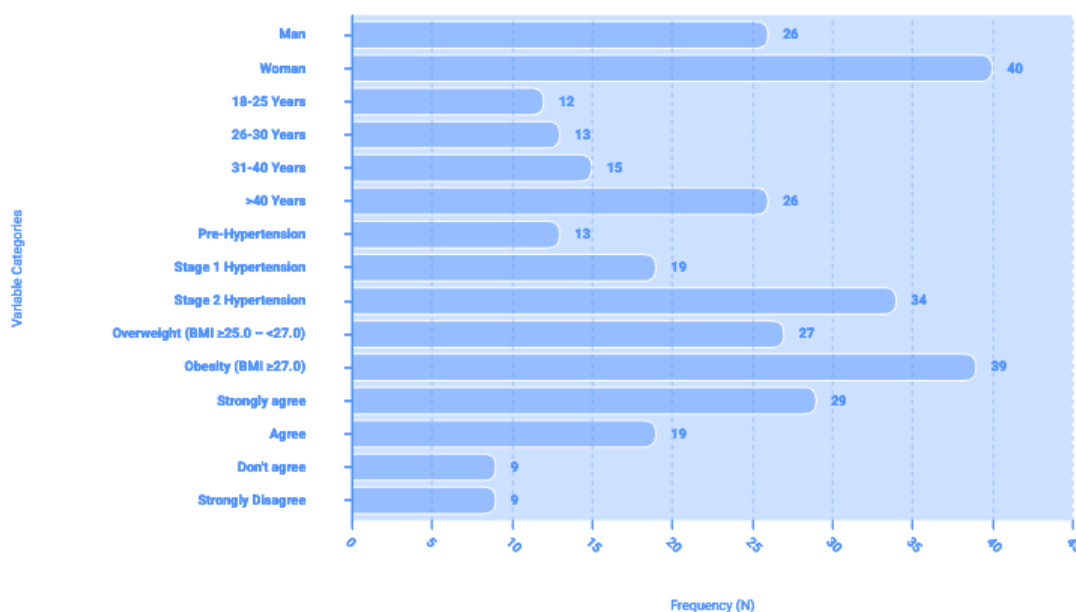


Figure 1. Comprehensive summary of respondent characteristics and application assessment

4. DISCUSSION

The clinical profile of study participants demonstrates substantial disease burden, with the majority classified as having stage 2 hypertension (51.52%), followed by stage 1 hypertension (28.79%) and pre-hypertension (19.70%). This distribution indicates that the Si-HIPO application was evaluated by individuals with clinically significant hypertension, enhancing the ecological validity of the assessment. The prevalence of hypertension in this study population reflects broader epidemiological trends, as hypertension remains a major public health concern globally [11]. Research has documented that uncontrolled hypertension, defined as systolic blood pressure ≥ 140 mmHg and/or diastolic blood pressure ≥ 90 mmHg despite antihypertensive treatment, represents the most prevalent risk factor for death and disability worldwide, particularly in developing nations [12]-[14].

The body mass index classification reveals that all respondents fell within elevated weight categories, with 59.09% classified as obese (BMI ≥ 27.0) and 40.91% classified as overweight (BMI ≥ 25.0 - < 27.0). This distribution is particularly relevant given the well-established relationship between obesity and cardiovascular disease. Systematic reviews and meta-analyses have synthesized evidence on the relationship between obesity and cardiovascular diseases, identifying obesity as a major contributing factor to adverse health outcomes [15]. The co-occurrence of obesity and hypertension reflects the clinical reality that these conditions frequently present together, with obesity serving as a significant risk factor for the onset of various metabolic disorders [16]-[18].

The combination of hypertension and obesity in the respondent population underscores the appropriateness of the Si-HIPO application's dual focus. Research has consistently demonstrated that the development of cardiovascular disease is influenced by multiple risk factors, including tobacco use, unhealthy diet, and physical inactivity, which could result in obesity, hypertension, dyslipidemia, and diabetes mellitus.

Continuing exposure to these risk factors can be prevented by routine screening and educational interventions for populations with clinical symptoms [19], [20].

The respondent evaluation of the Si-HIPO application demonstrated predominantly positive reception, with 72.73% of respondents expressing agreement or strong agreement with the application's utility. Specifically, 43.94% of respondents strongly agreed with the application's effectiveness, while 28.79% agreed. This level of acceptance is encouraging for the implementation of digital health education tools in chronic disease management. The development and validation of web-based applications for hypertension management have been recognized as an important strategy for improving patient outcomes, with successful implementations demonstrating the feasibility of digital health interventions [21]-[24].

The positive evaluation by the majority of respondents aligns with emerging evidence supporting the use of digital platforms for health education delivery. Social media and digital platforms have become popular venues for delivering health and wellness information, with studies examining the utility of nutrition education through dedicated platforms for supporting and enhancing health knowledge and reducing cardiovascular disease risk factors [25]. The Si-HIPO application's favorable reception suggests its potential utility in similar educational contexts.

Research on health education interventions emphasizes the importance of addressing diverse learner needs and preferences. Studies examining knowledge, attitude, and practice toward obesity among general populations have highlighted the variability in public understanding and engagement with health information [26]. Expert evaluation using structured methodologies can help identify specific areas requiring improvement, ensuring that the final application meets both scientific standards and user expectations [27].

The expert validity assessment employs Aiken's V coefficient, a widely recognized method for quantifying content validity based on expert ratings. The analysis of individual questionnaire items (Table 2) reveals consistently high validity coefficients, with nine of ten items achieving V values exceeding 0.80, indicating high validity. Item 3 demonstrated moderate validity with a V coefficient of 0.667, suggesting a potential need for refinement.

The Aiken's V coefficient provides a quantitative measure of the degree to which experts agree on the relevance and appropriateness of assessment items. Values exceeding 0.80 are generally considered indicative of high content validity, while values between 0.60 and 0.80 suggest moderate validity [24], [28]-[30]. The predominance of high validity coefficients in the Si-HIPO questionnaire items indicates strong expert consensus regarding the application's content appropriateness and educational value.

The aggregated validity analysis (Table 2) provides an overall assessment of the Si-HIPO questionnaire's content validity. The combined analysis of items 1-10 yielded a V coefficient of 0.802, classified as high validity. This aggregate measure indicates that the questionnaire as a whole demonstrates strong content validity, supporting its use as an assessment tool for the Si-HIPO application. The aggregated assessor scores (Assessor I: 30; Assessor II: 39) and corresponding S values (S_1 : 29; S_2 : 38) demonstrate the calculation methodology's robustness. The total sum ($\Sigma = 67$) divided by the denominator $n(c-1) = 6$ yields the final V coefficient of 0.802. This high-validity aggregate coefficient provides confidence in the questionnaire's overall appropriateness for evaluating the Si-HIPO application's educational effectiveness.

The use of digital platforms for health education has expanded significantly, with social media and mobile applications emerging as important channels for health information dissemination [31]. The Si-HIPO application represents a similar approach, leveraging digital technology to deliver educational content on hypertension and obesity. The Si-HIPO application aligns with broader efforts to develop structured self-management education programs for cardiometabolic diseases. Systematic reviews have examined the effect of structured self-management education programs on diabetes, hypertension, and obesity care outcomes, recognizing the importance of empowering individuals to manage their conditions through education [32].

The validation of the Si-HIPO application contributes to this evidence base by demonstrating the feasibility of developing culturally appropriate, validated educational tools for hypertension and obesity management. The high expert validity coefficients and predominantly positive respondent evaluations suggest that the application meets quality standards for educational interventions in this domain. The Si-HIPO application's dual focus on hypertension and obesity reflects the epidemiological reality of these conditions' co-occurrence. Research has consistently documented the association between obesity and hypertension, with studies examining the combined effects of these factors on health outcomes [33]. Cross-sectional studies have examined the association between behavioral risk factors and their physiological sequelae, including obesity, diabetes, and hypertension [34].

4.1. Study implications

The findings of this study carry several important implications for both research and practice. The high aggregate content validity coefficient ($V = 0.802$) and the predominantly positive respondent acceptance rate (72.73%) collectively suggest that the Si-HIPO application is a feasible and content-

appropriate digital educational tool for hypertension and obesity management, particularly among populations with clinically significant disease burden. Practically, these results provide a foundation for integrating the Si HIPO application into primary healthcare settings as a supplementary educational medium for structured self-management programs targeting cardiometabolic conditions. However, the moderate validity of item 3 ($V = 0.667$) indicates the necessity for targeted content revision to enhance overall instrument quality, while the limited number of expert assessors ($n = 2$) warrants expansion in future validation studies to strengthen inter-rater reliability estimates. Furthermore, subsequent research should employ experimental or quasi-experimental designs to evaluate the application's actual effectiveness in improving health knowledge, behavioral outcomes, and clinical parameters such as blood pressure and body mass index among hypertensive and obese populations.

5. CONCLUSION

The Si-HIPO application demonstrates acceptable content validity (aggregate Aiken's $V = 0.802$) and positive user acceptance (72.73% agreement), suggesting its potential as an educational medium for hypertension and obesity management. However, several limitations warrant consideration. The study involved only two expert assessors, which may limit the robustness of validity estimates. The sample was drawn from a single clinical setting, restricting generalizability. Additionally, one questionnaire item exhibited only moderate validity ($V = 0.667$), necessitating revision.

The cross-sectional design precludes assessment of the application's long-term educational effectiveness. Future research should incorporate larger expert panels, multi-site sampling, and longitudinal experimental designs to evaluate the application's impact on knowledge improvement and behavioral outcomes before broader implementation can be recommended.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nvestigation

R : **R**esources

D : **D**ata Curation

O : Writing - **O**riginal Draft

E : Writing - Review & **E**diting

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

ETHICAL APPROVAL

This research has received ethical approval from the Surakarta Ministry of Health Polytechnic with the number: Etik/LH/2202/Poltekkes Kemenkes Surakarta/2025.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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